Evolution of the Surgical Residency System in Switzerland: An In-Depth Analysis Over 15 Years

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Abstract: Background: The landscape of surgical training has been subject to many changes over the past 15 years. This study examines resident satisfaction, determinants of satisfaction, demographics, working hours and the teaching rate of common operations in a longitudinal fashion with the aim to identify trends, shortcomings and possible ways to improve the current training system. Methods: The Swiss Medical Association administers an annual survey to all Swiss residents to evaluate the quality of postgraduate medical training (yearly respondents: 687-825, response rate: 68-72%). Teaching rates for general surgical procedures were obtained from the Swiss association for quality management in surgery. Results: During the study period (2003-2018), the number of surgical residents (408-655 (+61%)) and graduates in general surgery per year (42-63 (+50%)) increased disproportionately to the Swiss population. While the 52 working hour restriction was introduced in 2005 reported average weekly working hours did not decline (59.9-58.4 h (-3%)). Workplace satisfaction (6 being highest) rose from 4.3 to 4.6 (+7%). Working climate and leadership culture were the main determinants for resident satisfaction. The proportion of taught basic surgical procedures fell from 24.6 to 18.9% (-23%). Conclusions: The number of residents and graduates in general surgery has risen markedly. At the same time, the proportion of taught operations is diminishing. Despite the introduction of working hour restrictions, the self-reported hours never reached the limit. The low teaching rate combined with the increasing resident number represents a major challenge to the maintenance of the current training quality.

DOI: https://doi.org/10.1007/s00268-020-05552-9

Evolution of the surgical residency system in Switzerland; an in-depth analysis over 15 years

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Running head: Evolution of a surgical training system

Keywords: Education, Training, Residency, Satisfaction, Global surgery, Laparoscopy

Conflict of interest: The authors declare that they have no conflict of interest

Manuscript word count: 2750

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Conclusions: The number of residents and graduates in general surgery has risen markedly. At the same time, the proportion of taught operations is diminishing. Despite the introduction of working hour restrictions the self-reported hours never reached the limit. The low teaching rate combined with the increasing resident number represent a major challenge to the maintenance of the current training quality.

Introduction

“A good surgeon is a doctor who can operate and knows when not to operate.” (Theodor Kocher, 1841–1917) [1]. This quote by one of the founding fathers of modern surgery perfectly summarizes the challenges of surgical training. Skill and knowledge need to be passed on from teacher to trainee in a few short years all while keeping a surgical department running. However, the attitude towards work and priorities of younger surgeons have shifted towards a preference for a controllable lifestyle and purpose in a career [2-4]. This challenge has become more accentuated in the past decades. Working hour regulations have become increasingly strict worldwide in an attempt to address this issue. In 2003, duty hours were restricted to 80 hours a week in the United States. Switzerland soon followed in 2005 by limiting the weekly working time to 52 hours and the European Union to 48 hours by 2009 [5-7]. Furthermore, new medical reimbursement systems implemented in several European countries do not account for the cost of resident training, **estimated at around 60 000 USD per resident per year [8]. An example is the introduction of the “Swiss Diagnosis Related Groups” reimbursement system in Switzerland in 2010 [9, 10]. This likely discourages hospitals to provide training, increases the time residents spend on service tasks and potentially deprives a surgical trainee of critical learning experiences [11, 12].** New technologies like the emergence of robotic surgery and increasingly complex laparoscopic surgery have reshaped the surgical landscape and made surgical training even more challenging [13, 14]. These profound changes raise the question of whether the current system in many central European countries, of which the Swiss system is prototypical, is adequately providing high quality training and satisfying working conditions for the next generation of surgeons.

SURGICAL RESIDENCY SWITZERLAND

The general surgical training in Switzerland starts with six years of undergraduate medical school [15]. The post-graduate training is governed by the Swiss Surgical Society but leaves much flexibility to the individual resident. In most cases, a resident receives training in at least one community and one university-based hospital. **The total residency takes a minimum of six years. At least four years must be spent in general surgery, with a maximum of two years spent in subspecialty training like for example thoracic surgery or urology.** To present for the final board examination, a resident must have completed 510 surgical procedures, participated in four postgraduate training courses, and published in a scientific journal [16].

To summarize, in the past fifteen years, strict working hour regulations were implemented, training guidelines changed, and a new reimbursement system was introduced in Switzerland this in conjunction with ongoing cultural and technological changes. This study looks at several indicators of surgical training quality in a longitudinal fashion [17] with the aim to identify trends, shortcomings and ways to improve our current surgical training system.

Materials and methods

Demographic data

Swiss demographic data were obtained from the Swiss Federal Office of Statistics [18]. The number of surgical residents, their educational background and the number of newly certified surgeons were obtained from the Swiss Medical Association [19].

Resident surveys

The Swiss Medical Association administers an annual survey to all residents in Switzerland to evaluate the quality of postgraduate medical training. The surveys are conducted by the Swiss Institute for Postgraduate Medical Education and the Swiss Federal Institute of Technology Zurich. Data from 2003 to 2018 were analyzed (yearly respondents: 687-825, response rate: 68-72%). **Anonymity is ensured by sending the completed questionnaire directly back to the administering institute, which has no affiliation to any of the postgraduate training programs. For programs with less than 4 completed questionnaires (9% of programs in 2018), the residents can indicate whether the data can only be used for the national analysis. The evaluation contains eight dimensions, rated on a balanced 6-point Likert scale**, where 1 = does not apply at all, and 6 = fully applies. In 2005 and 2013, some revisions were made, so the scales are only comparable to a limited extent. The dimension global satisfaction contains 4 items (until 2012: 3 items), an example item is: "I am generally satisfied with my current work situation." The dimension working climate contains 3 items (2003: 8 items, 2005-2012: 4 items), an example item is: "There is a good working climate in our training center (doctors and nursing staff)." The dimension leadership culture contains 5 items (2003: 5 items, 2005-2012: 6 items), an example item is: "My superiors help me when I have difficulties at work." Lastly, the

residents were asked how many hours they spent at work in a typical week. **The questionnaire is available as supplemental file in German and French.**

Teaching rates

Teaching rates for general surgical procedures from 2003 to 2018 were obtained from the national database of the Swiss Association for Quality Management in Surgery (AQC). This association maintains a prospective database of inpatient data from Swiss public hospitals since 1995. Residents are defined as non-board-certified physicians employed in a training position by a surgical department without distinction of the postgraduate year. Of all recorded procedures, the percentages of cholecystectomies, appendectomies and inguinal hernia repairs (open or laparoscopic) performed by residents or staff surgeons as primary surgeon were determined. Operations performed by a resident under supervision of a board-certified physician were classified as teaching operations.

Data analysis

Working hours of residents were only analyzed for residents who worked fulltime (>95%), worked more than two months at the respective hospital, and corrected for outliers. Spearman correlation analyses were carried out for each year separately.

Results

Demographics of Swiss surgical residencies

From 2003 to 2018, the population of Switzerland increased from 7.32 to 8.42 million (+15%). During the same time period, the number of resident physicians working in surgical departments increased from 1016 to 1134 (+12%), while the number of residents training for board certification in general surgery increased disproportionally from 408 to 655 (+61%) and the number of surgical residents training for a different board certification declined from 608 to 479 (-21%) (Figure 1). This trend is further reflected by an increase in the number of new graduates of surgical residency programs from 42 to 63 (+50%). Interestingly, despite an overall increase in residents, the number of surgical residents with domestic diplomas decreased from 658 to 552 (-16%).

Working hours

Reported weekly working hours of Swiss surgical residents decreased slightly and only temporarily from 58.9 in 2005 to 56.0 hours in 2006 after the introduction of working hour regulations in 2005. However, the effect was of short duration. The average work week over the 15 years amounted to 57.7 hours and never fell below the limit of 52 hours. This in contrast to anesthesiology training programs where the working hour limitation had a lasting effect on reported working hours, they remained below the legal limit of 52 hours since 2011 (Figure 2).

Teaching rate of common surgical procedures

From 2003 to 2018, the teaching rate of basic surgical procedures, generally regarded as essential for the independent practice of a board-certified general surgeon, never reached 30% for any of the three studied operations. The trend observed was generally towards less

teaching. The rate of inguinal hernia repairs used for teaching dropped from 26.6% to 11.2% (-57.9%) and the teaching rate of cholecystectomies from 22.2% to 17.6% (-21.7%). Only the rate of appendectomies that were taught to residents in training increased slightly from 25.3% to 27.9% (+10.1%) (Figure 3).

Resident satisfaction

Global workplace satisfaction of Swiss surgical residents has remained relatively stable during the studied period from 2003 to 2018, and only increased slightly from 4.3 to 4.6 (with 6 being the highest). After the introduction of working hour restrictions in 2005 we observed an increase in global satisfaction to 4.6 compared to 4.2 in the previous year. Satisfaction has thereafter remained stable. This is a consistently lower value than observed in other specialties such as anesthesiology (Figure 4).

There is only a weak correlation between global satisfaction and the reported weekly working hours. However, it seems that this correlation grew stronger during the past 15 years. Nevertheless, other dimensions like working climate and leadership culture have a stronger correlation with global satisfaction than working hours (Table 1).

Discussion

This study is the first of its kind looking at different indicators of surgical training in a longitudinal fashion over the past 15 years in Switzerland, a country that stands exemplary for many countries in Western Europe.

During our study period, we observed a marked increase in general surgery residents aspiring board certification (+61%) and successful general surgery graduates (+50%). This leads to a ratio of surgical residents per inhabitants that is more than five times higher in Switzerland than the United States (136 vs. 26 surgical residents/1 million inhabitants) [15, 20]. Although reasons for the increase in residents cannot be definitively identified, the temporal correlation suggests that working hour restrictions may be one factor. By limiting the number of hours a resident is allowed to work, the program administration is pressed to hire more residents to guarantee coverage of the call schedule. This situation is accentuated by an overseeing body in Switzerland that does not set clear limits for the number of residents a hospital can hire.

On the other hand, the teaching rate of basic surgical procedures like inguinal hernia repairs or cholecystectomies have decreased to a mere 11-28% in 2017. The drop in taught inguinal hernia repairs from 26.6% to 11.2% was unexpectedly large. **This might in part be due to the increased use of laparoscopic and robotic techniques for inguinal hernia repairs, which are less frequently taught because they are often considered a more advanced procedure [21-23].** Even though outcomes are comparable between inguinal hernia repairs performed by supervised residents and board-certified physicians [24, 25]. This highlights the need for a cultural change and structured training in and outside of the operating room so that resident training does not have to take second priority to technical advancements. **Possible solutions could be mandatory laparoscopic and robotic surgery courses for junior**

residents and faculty development programs to improve faculty comfort in resident teaching.

The combination of lower teaching rates and higher number of residents observed during our study period strongly suggest decreased exposure to surgical procedures and prolonged length of training. This finding is in line with most of the available literature [26-28]. In contrast, a Dutch study from 2015 did not find a negative effect of reduced working hours on case numbers despite an increase in the number of graduating surgeons [29]. By organizing surgical training in networks combining training in university and district hospitals under one curriculum, they offer one example of successful adaptation to lower working hours. **This concept is also appealing in regards to the situation of private hospitals. In Switzerland private clinics perform up to one third of "bread and butter" operations while they only employ 1.6% of the surgical resident workforce [30]. The organization of training in networks consisting of university, community and private hospitals therefore offers untapped potential to increase surgical exposure of junior surgeons.**

In the beginning of the 20th century central Europe used to be exemplary in surgical training and pioneers like Halsted came to Vienna, Leipzig and Berne to learn from Billroth, Thiersch and Kocher [1, 31]. Times have changed and efforts are unavoidable to maintain the training quality in Europe. In North America surgical training is clearly structured according to the year of training with well-defined competencies to master each year. The residency system is overseen by a strict governing body enforcing sanctions if a minimum quality standard is not reached and graduates finish with more than double of the minimum operating volume required in Switzerland in less time [15, 32]. In Switzerland the increasing number of residents and the low teaching rate will make it increasingly difficult for the training system to produce competent surgeons at the end of residency. Several efforts by the Swiss Association of Surgery are underway

to move from a time-based training system towards a modular competence based curriculum, essential for maintaining training quality [33, 34]. Recently an initiative called "Core Surgical Curriculum" was launched. Its goal is to improve knowledge and skills of junior surgeons during the first two years of training through various courses an structured training [35]. Regarding the low teaching rate, the cost of training needs to be reimbursed adequately to hospitals to prevent less teaching for efficiency reasons. The Swiss Surgical Association put this demand forward, however no decision has been taken by the responsible authorities in this regard. Additionally a governing body that ensures that every program provides a minimum volume of surgical training for each resident hired could help increase the teaching rate and make it more difficult to hire residents mainly for service tasks.

The addition of advanced practice providers such as nurse practitioners also offers an attractive solution. Advanced practice providers are able to reduce resident workload, stress level and most importantly increase educational opportunities. Importantly, the introduction of advanced practice providers has not led to an increase in morbidity, mortality or in-hospital complication rate [36, 37]. Many surgical departments in Switzerland use clinical nurses successfully to reduce the load of service tasks for residents and guarantee continuity [38]. However, the relatively high cost of advanced practice providers compared to residents (especially when the lower working hours of 42h/week are taken into account) may prevent hospitals to take advantage of this precious resource, a situation shared with many countries in Europe.

Another important point in this context is intraoperative autonomy. The possibility of taking independent decisions and progressively demonstrating greater responsibility and autonomy is a mandatory step towards independent practice and ideally achieved by the end of residency [33]. This process has been presumed to happen organically,

however increased pressure for efficiency in the operating room and expansion of residencies have decreased the opportunities for this trust between attending and resident to grow. Many groups recently developed tools to measure intraoperative entrustment objectively and to better understand the mechanisms involved [39, 40]. This knowledge will contribute to foster the pivotal process of progressive entrustment. Faculty development initiatives and the use of tools to help residents identify weaknesses will assist residency programs in improving training quality and efficiency [40, 41].

Despite the introduction of strict regulation the reported number of working hours never reached the limit of 52 hours, thus highlighting the challenge of enforcing such legal restrictions [42, 43]. Perceived workplace satisfaction temporarily increased after the introduction of strict duty hour regulations in 2005 but has thereafter remained stable. **One hypothesis is, that over time an increased satisfaction with working conditions was negatively compensated by dissatisfaction with surgical training, a factor that we could not assess with our questionnaire. The increase in overall satisfaction immediately after the introduction of working hour limitations** matches the results of studies on the effect of resident duty hour restriction in the United States that reported an overall improvement in resident wellbeing and burnout [44]. Nevertheless, our results indicate that other factors like the working climate and leadership culture have a stronger influence on satisfaction than working hours. This finding supports previous studies that highlighted the importance of leadership and mentoring programs [45, 46]. In a study from 2015, only a small proportion of the Swiss surgical community reported involvement in structured mentoring programs, a powerful tool in sustainably improving resident satisfaction and retention [47, 48].

This present study has several limitations. A correlation of our results to the outcome of residency training, e.g. number of operations per graduate, board achievement rate,

number of years in training, was not possible since the authors were not granted access to these data due to privacy concerns. We hope the governing bodies responsible for training will make these data publicly available to obtain objective outcome measures [49]. Furthermore, we could not exclude that certain programs exerted pressure on residents to complete the questionnaire favorably to the department, even though anonymity was guaranteed through the completion process. We expect a potential bias to be small and constant over time. The questionnaire administered is designed for all residency specialties, a section specifically about satisfaction regarding surgical training quality is lacking but would be of great value.

Surgical training is a highly complex system, that constantly needs to adapt to a changing environment and is influenced by many different factors, often with competing interests. Our study shows a fast growing number of surgical residents and graduates, a teaching rate that is disappointingly low and resident satisfaction below comparable specialties. The surgical community is in dire need of solutions such as **the introduction of a competency based curriculum,** advanced practice providers, organization of training within networks, structured mentoring programs and strict oversight over training hospitals. These solutions could help to improve the quality of training for future generations of surgeons.

Acknowledgments

We thank the ACQ (Swiss association for quality management in surgery; Arbeitsgemeinschaft für Qualitätssicherung in der Chirurgie) for providing the data on teaching rates for different surgical procedures.

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